US006723904B1

(12) **United States Patent**
Dolan et al.

(10) **Patent No.: US 6,723,904 B1**
(45) **Date of Patent: Apr. 20, 2004**

(54) **AUTOMATED PLAYER FOR STRINGED INSTRUMENTS**

(75) Inventors: **Thomas Allen Dolan**, Naples, FL (US); **Don A. Gilmore**, Kansas City, MO (US)

(73) Assignee: **QRS Music Technologies, Inc.**, Naples, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/325,123**

(22) Filed: **Dec. 19, 2002**

(51) **Int. Cl.**[7] **G10D 1/08**
(52) **U.S. Cl.** **84/267**; 84/290
(58) **Field of Search** 84/267, 290, 291, 84/294

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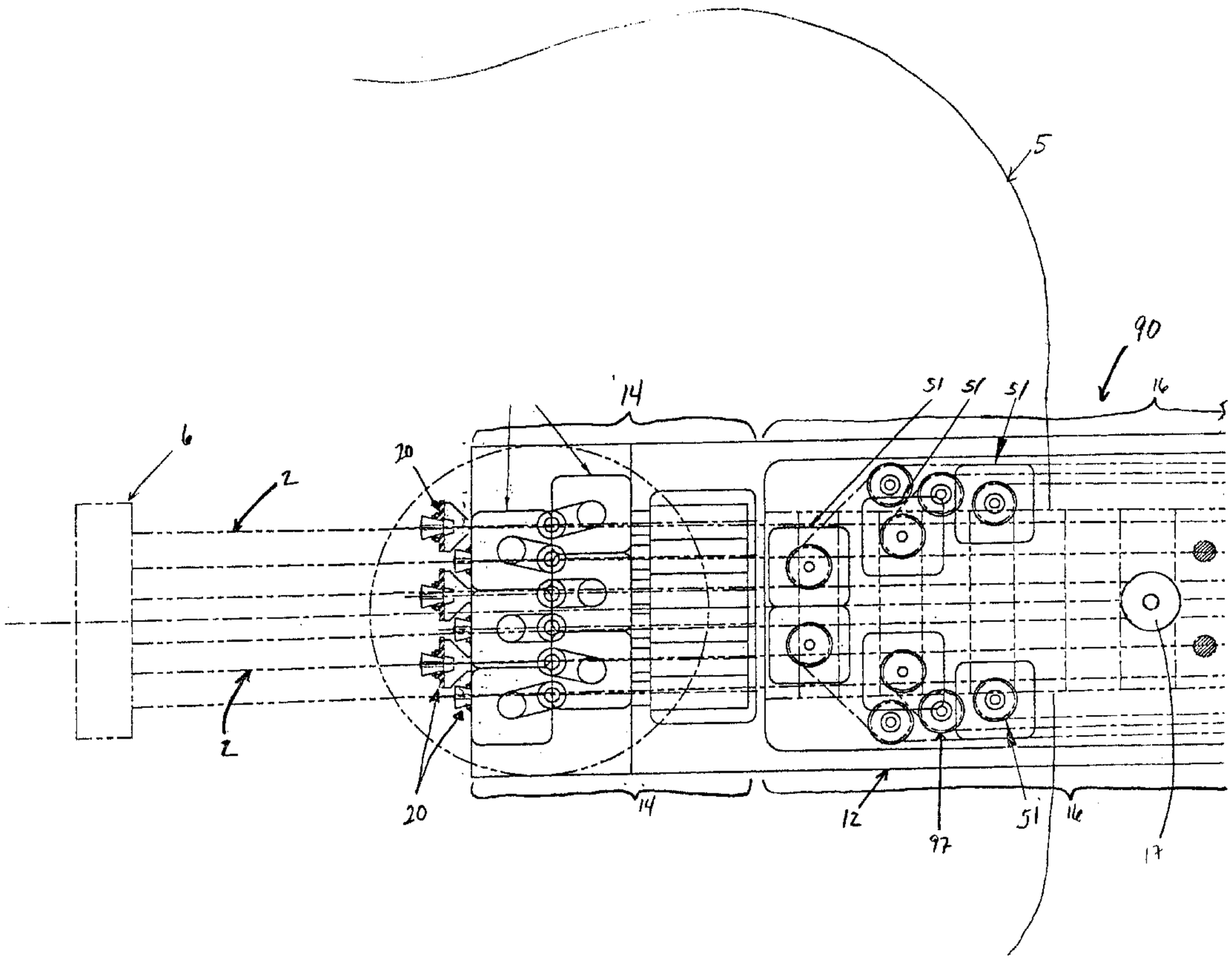
Primary Examiner—Kimberly Lockett
(74) *Attorney, Agent, or Firm*—Barnes & Thornburg

(57) **ABSTRACT**

An automated player for stringed instruments having a body portion including independent plucking and fretting mechanisms. The plucking mechanism includes a rotary plectrum assembly having a plurality of extendable quills positioned with its rotational axis parallel to a string of the instrument. The plectrum assembly is selectively rotatable by a first stepper motor and the quills are selectively extendable by an electric solenoid actuator, thus allowing for variable displacement of the string to produce vibration of variable intensity during operation. The fretting mechanism includes a carriage mounted to a belt and selectively driven by a second stepper motor along a track parallel to the instrument string. The carriage is in compressive contact with the string and thus may be selectively positioned at appropriate frets to shorten the vibrating length of the string. The player includes an embedded electronic circuit that controls the operation from programs installed or serially downloaded.

22 Claims, 9 Drawing Sheets



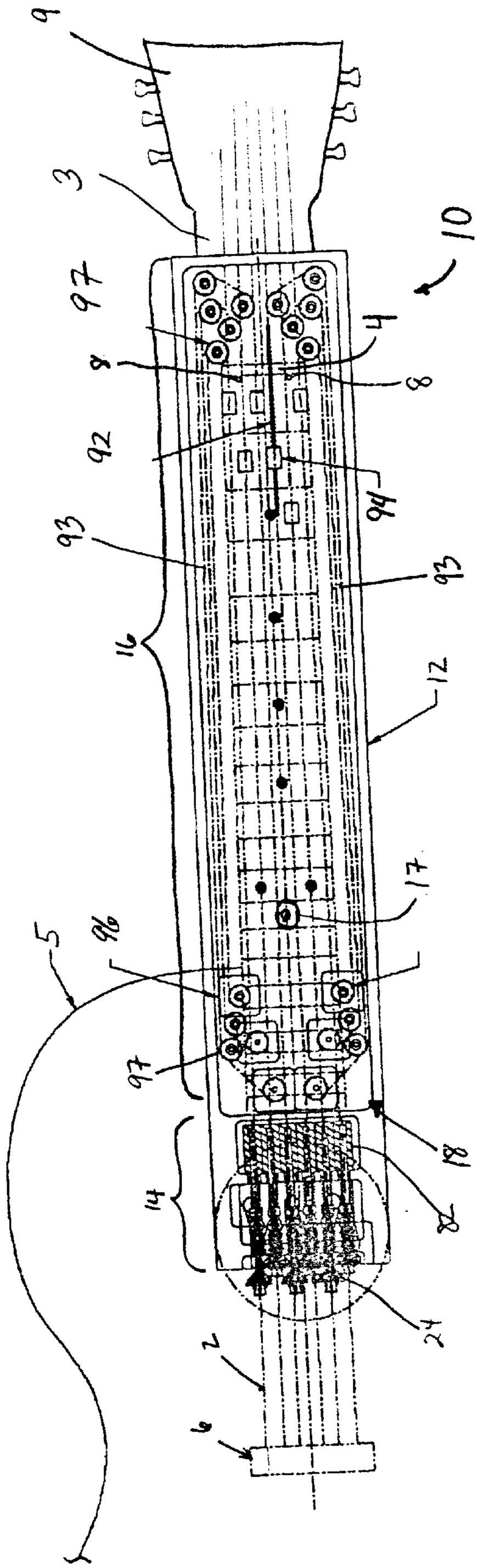


FIG. 1

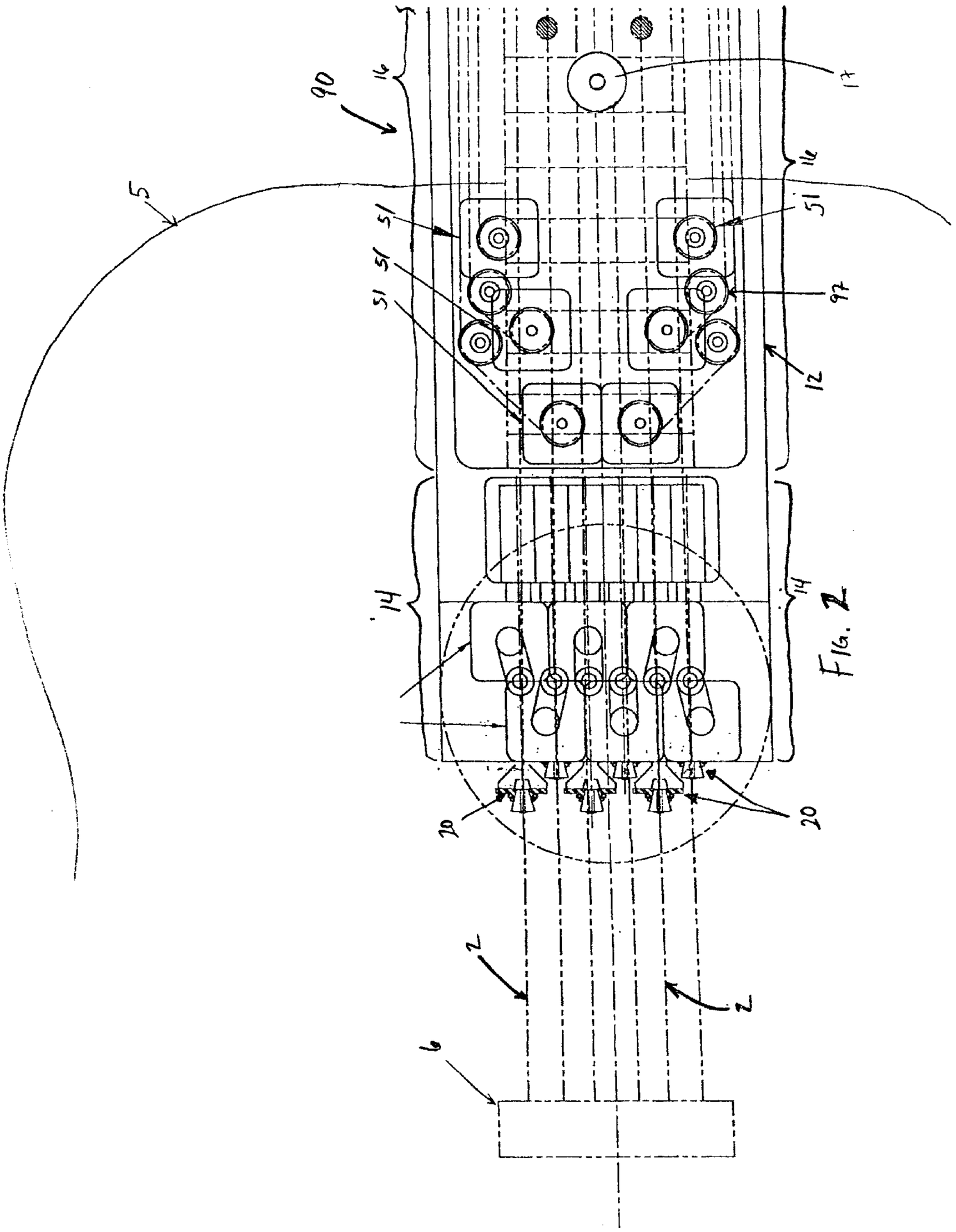


FIG. 2

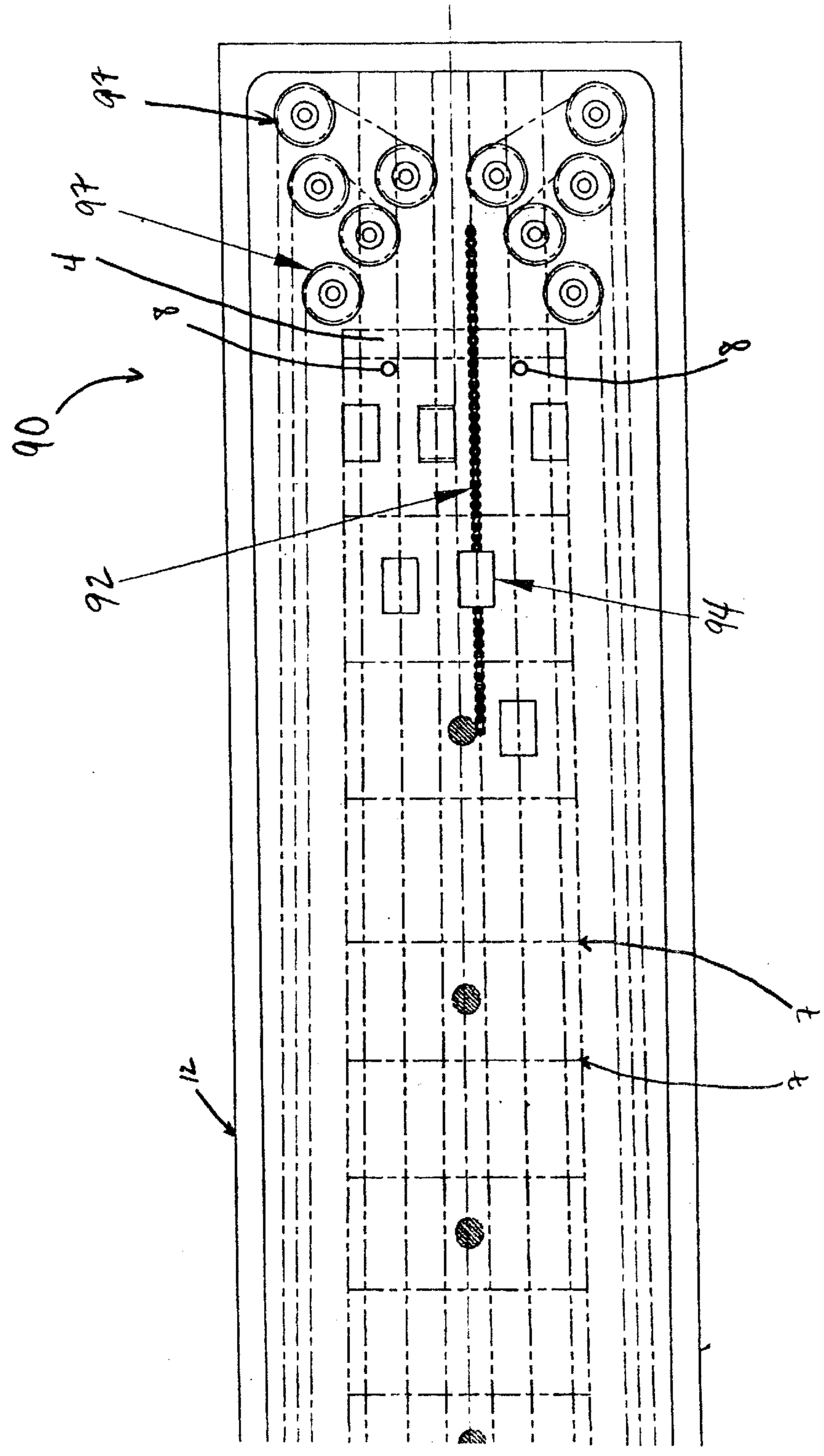


FIG. 3

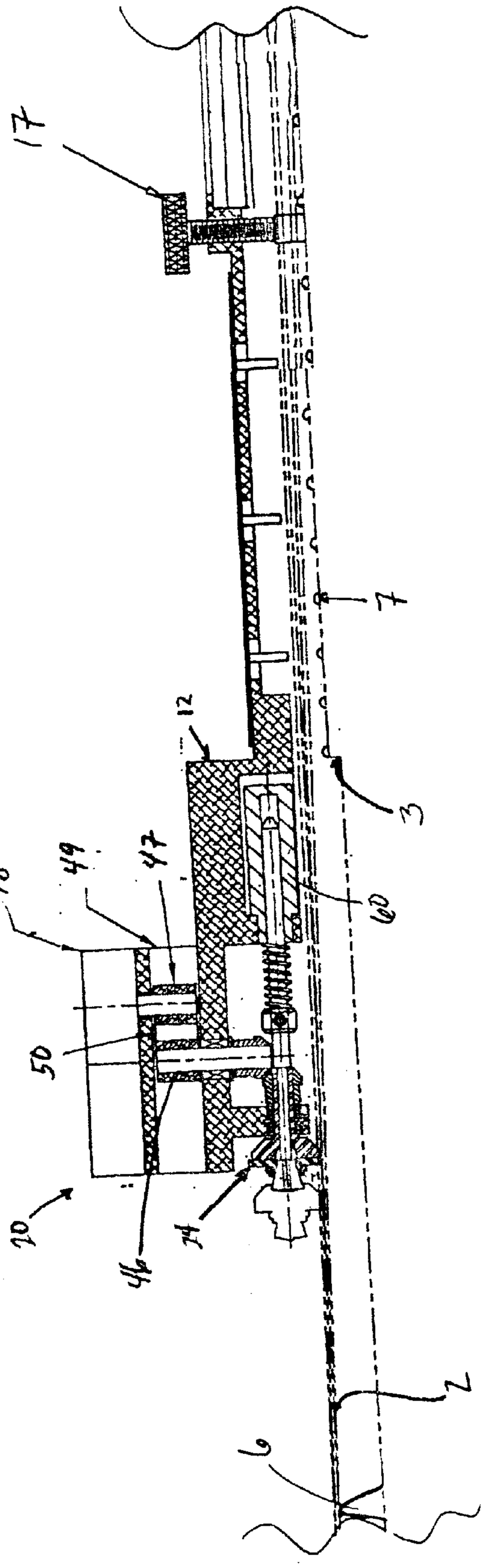


FIG. 4

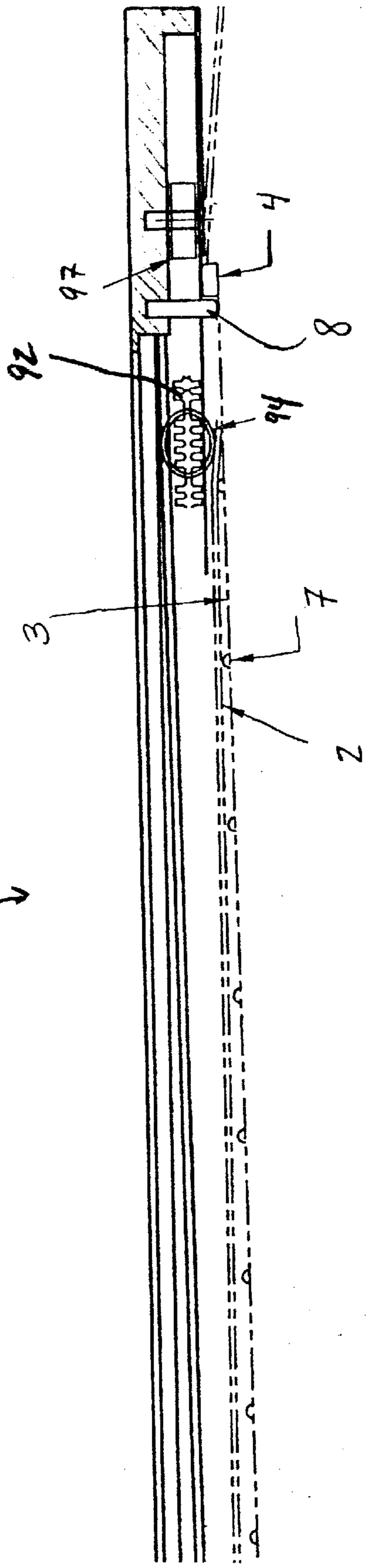


FIG. 5A

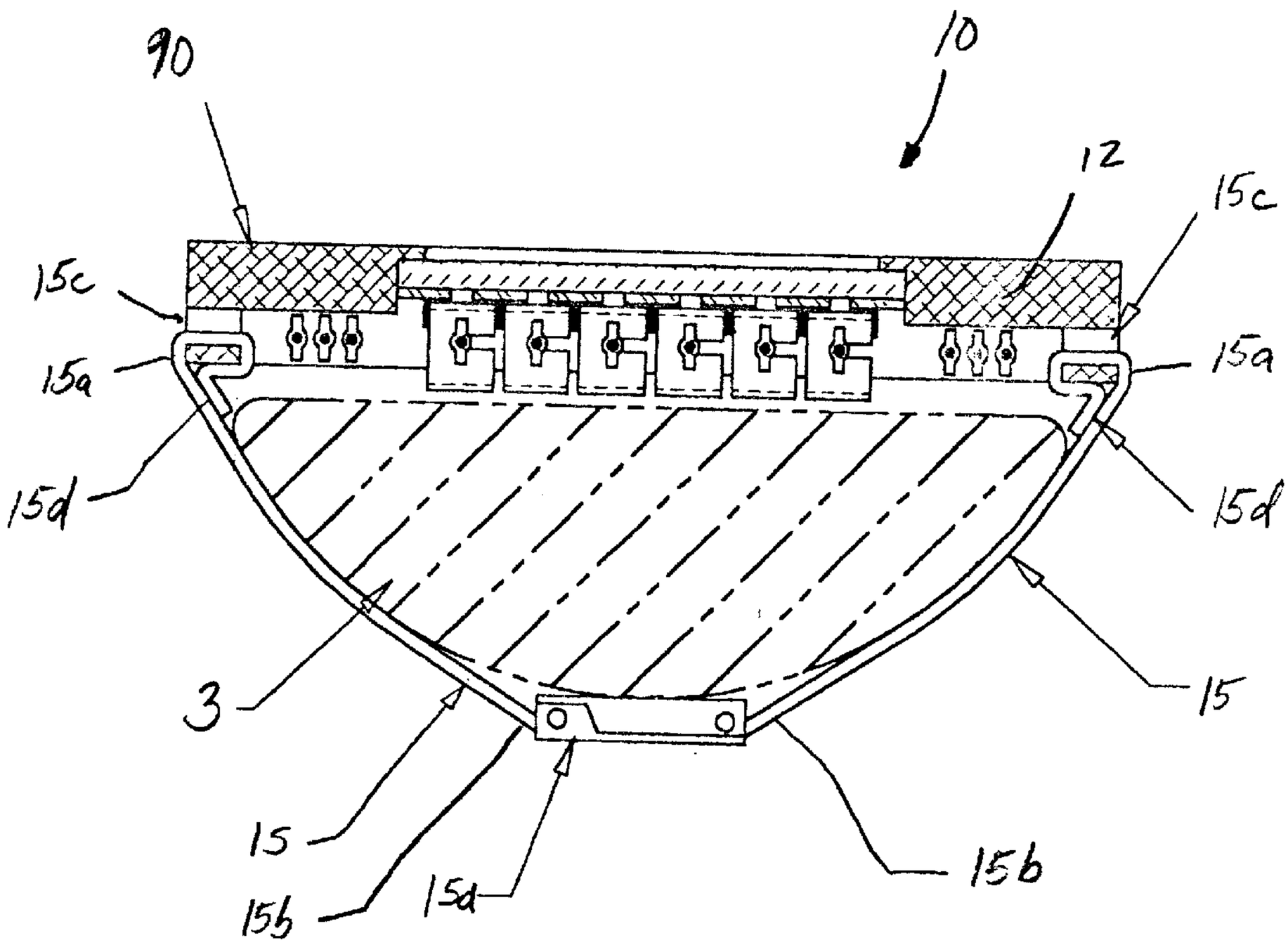


FIG. 5B

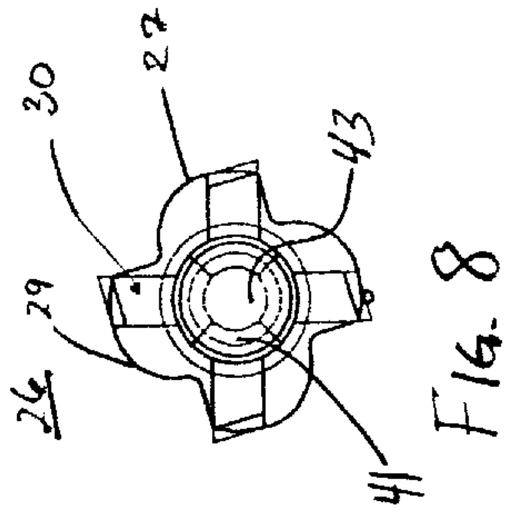


FIG. 8

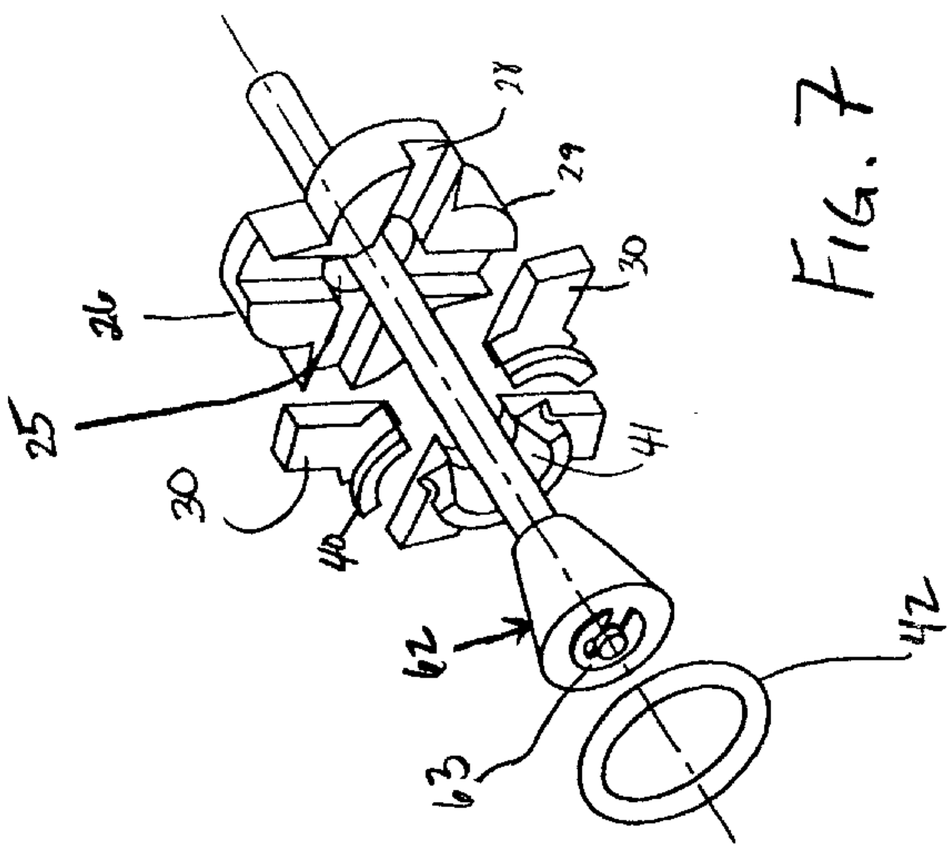


FIG. 7

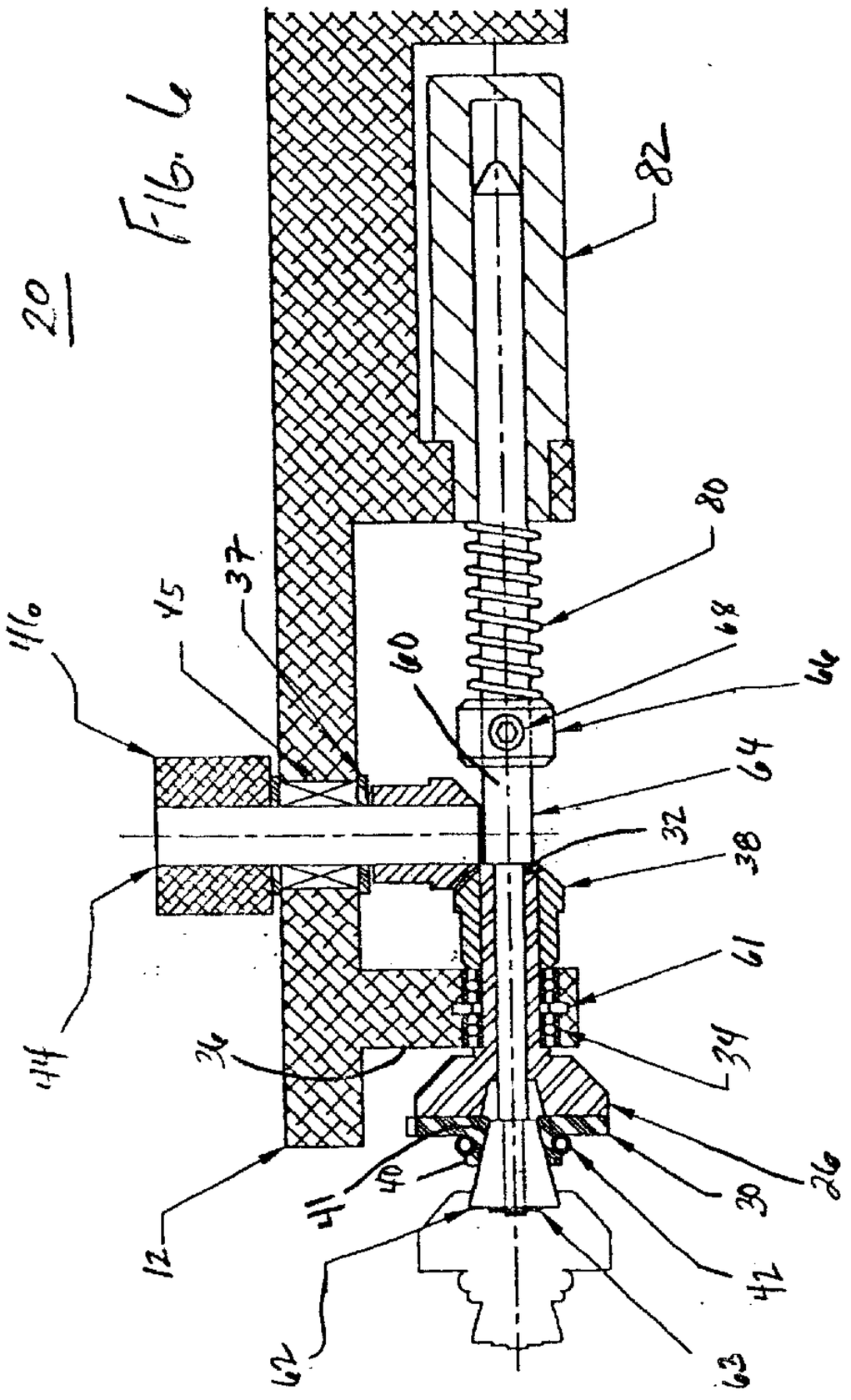


FIG. 6

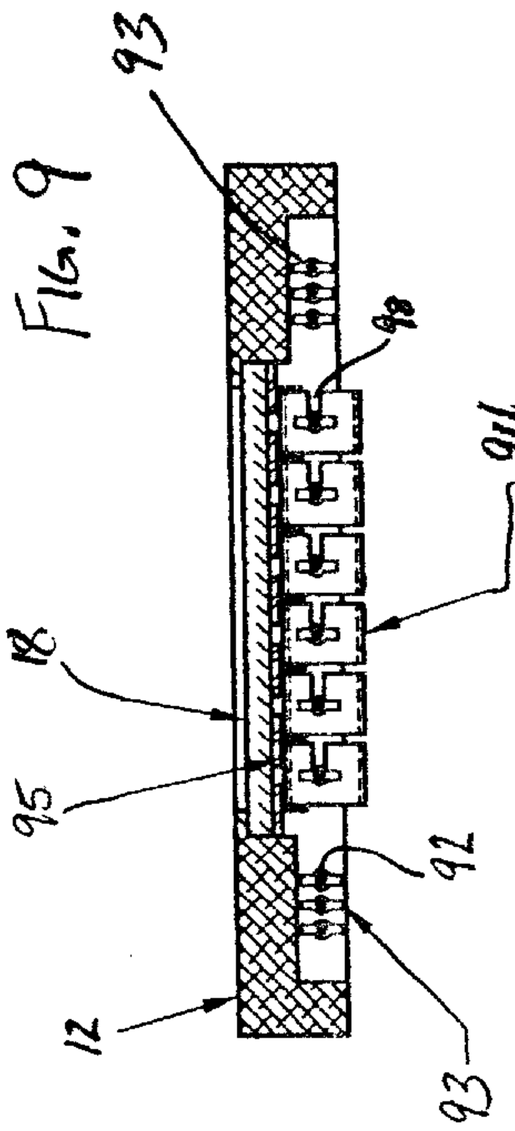


FIG. 9

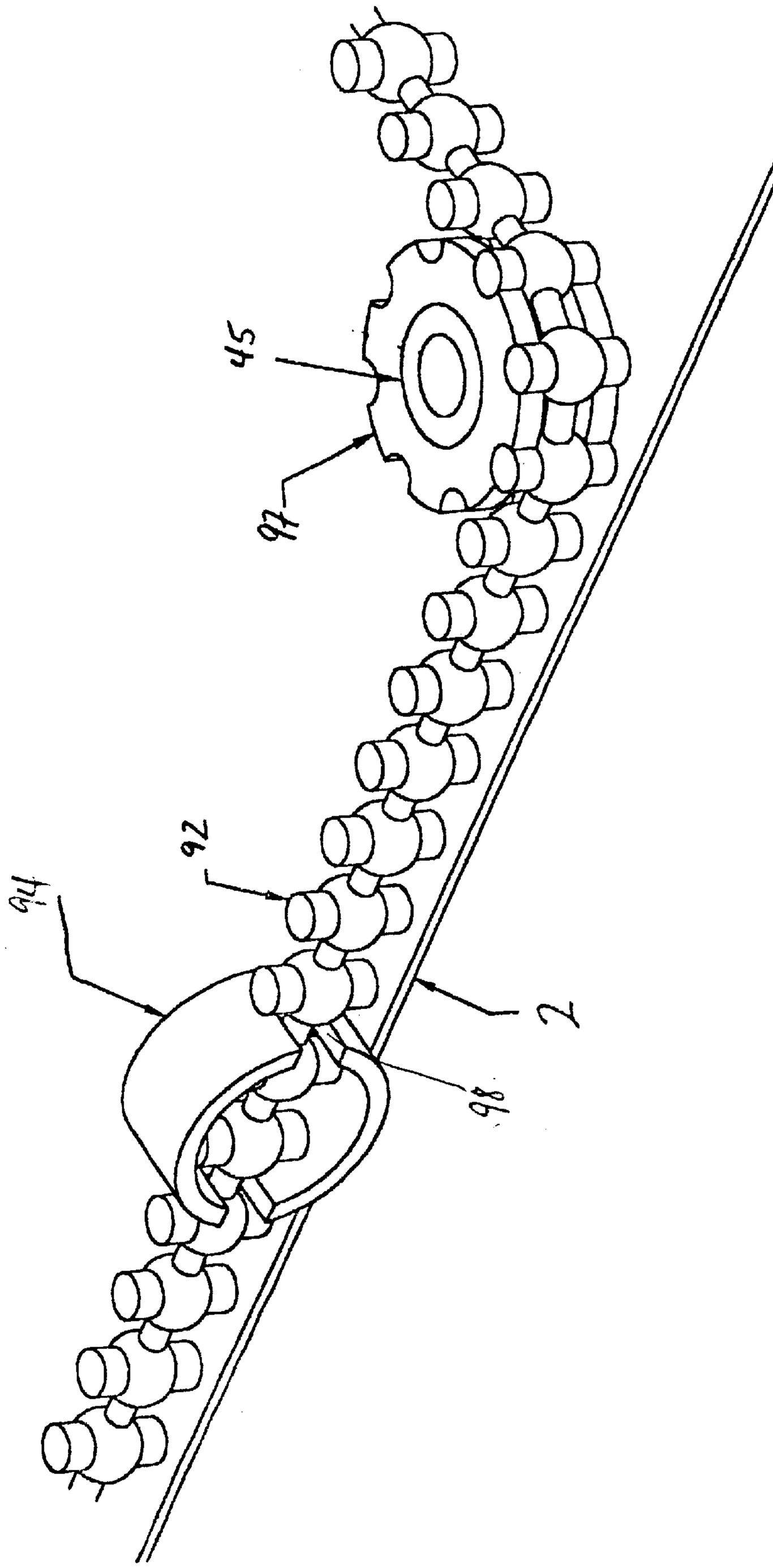


Fig. 10

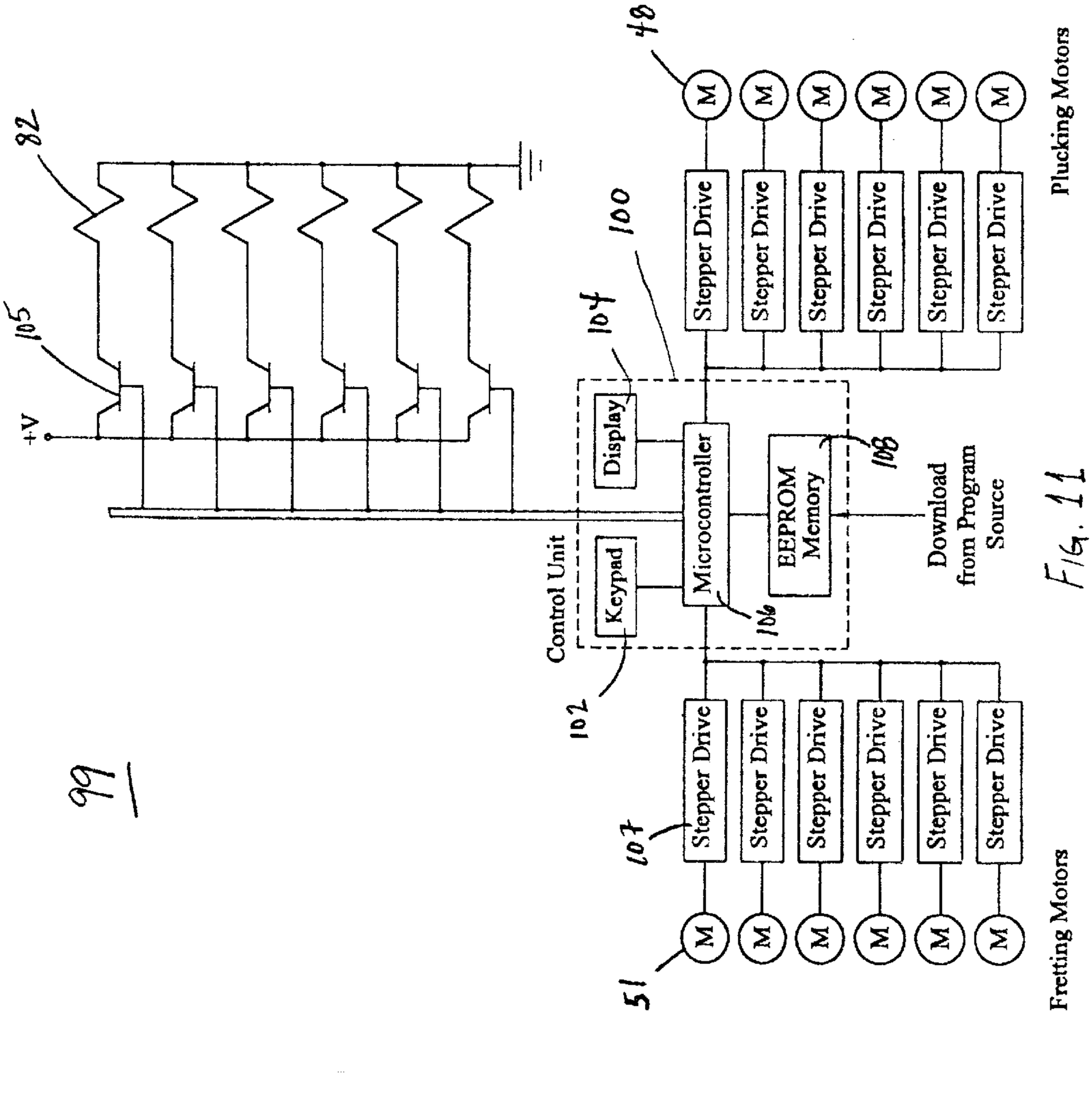

99
82
105
+V
104
100
Control Unit
Keypad
Display
Microcontroller
106
EEPROM Memory
108
Download from Program Source
102
Stepper Drive
M
48
Plucking Motors
107
51
Fretting Motors

FIG. 11

AUTOMATED PLAYER FOR STRINGED INSTRUMENTS

BACKGROUND OF THE INVENTION

The present invention relates to an automated player for playing stringed instruments. More specifically, it relates to an automated apparatus for playing unmodified, traditional stringed instruments such as the guitar.

Automated musical instruments have been in use for some time, and percussion instruments such as pianos, accordions, drums, marimbas, cymbals, etc., as well as wind instruments such as organs and calliopes have traditionally been the object of automation. For example, automated pianos known as player pianos have been in existence for well over a century. The use and operation of such player pianos are well known.

The automation of stringed instruments, conversely, has not been met with a great deal of success by manufacturers of automated instruments. Unlike the automation of percussion or wind instruments, many stringed instruments require more than a single action to result in a played note. Musicians play traditional stringed instruments, such as the guitar, by plucking or strumming the strings with one hand while pressing the individual strings against the neck or fingerboard of the instrument with the fingers of the other hand. When a string is depressed in such a manner, it bridges over raised metal ribs in the fingerboard or "frets," thus shortening the portion of that string available to vibrate after being plucked or strummed. A shorter vibrating portion results in a higher pitch for that string than occurs when the full length is allowed to vibrate, thus allowing many notes to be played on a single string.

Another method employed by musicians to manipulate the sounds produced by a stringed instrument includes stopping or "damping" the vibration of the strings before the natural dissipation of vibrating energy. Damping is accomplished by a variety of methods including using the side of the plucking or strumming hand, releasing or changing the fret position of depressed strings with the other hand, or lightly touching the strings with available fingers.

To accomplish this multi-action (plucking, fretting and damping) on stringed instruments, the prior art devices have required physical modification of the traditional instrument or large, unwieldy structures that are difficult to set up and effectively use. It is therefore an object of the present invention to provide an automated player having an automated plucking, fretting and damping means that is separate and independent from the instrument, but may easily be attached or mounted to an unmodified stringed instrument. It is a further object of the present invention to provide an automated player for stringed instruments that can pluck or strum the strings and selectively fret the strings and that includes an electronic circuit control system to produce music from pre-programmed or serially downloaded music programs. Furthermore, since the present invention operates without the need of a musician there are no human limitations, such as number of fingers, so music can be programmed and played that would be impossible for a human musician to perform.

SUMMARY OF THE INVENTION

An automated player for playing stringed instruments that may be easily mounted to an unmodified stringed instrument. The automated player includes a rectangular body having a first end and a second end. The first end is adapted to house one or more plucking mechanisms. The second end is adapted to house one or more fretting mechanisms.

The plucking mechanisms include a rotary plectrum assembly adapted to be placed with its rotational axis parallel to the axis of an instrument string and in intermittent mechanical communication with the instrument string. The rotary plectrum assembly includes a plurality of radially extending spokes, said spokes including radially extendable quills for displacing or plucking the instrument string as the plectrum assembly is rotated. The plucking mechanism includes a plectrum driver operable and in mechanical communication with the plectrum assembly to impart controlled rotational movement to the rotary plectrum assembly. The plucking mechanism further includes an actuator assembly having an actuator driver operable and in mechanical communication with the radially extendable quills for controllably adjusting the radial extension of the quills, thereby increasing or decreasing the amount of string displacement during a rotational pass of a quill, and hence the volume produced by the string.

The fretting mechanisms include a carriage assembly having a carriage and a carriage driver. The carriage is adapted to be in mechanical communication with the carriage driver and is positioned such that it is in compressive communication with a string of the instrument. The carriage driver is operable to provide controlled linear movement of the carriage along a suitable length of the instrument string.

The automated player includes an embedded electronic circuit to control the drivers and actuators from programs installed in random access memory or installed via a serial connection to a compatible computer or other MIDI device. The embedded electronic circuit, upon proper input from stored programs or serially downloaded programs, controls the mechanical operation of the plectrum driver, actuator driver and carriage driver to respectively rotate the rotary plectrum assembly, energize the actuator assembly and move the carriage to desired positions to produce the desired musical note.

These and other features of the present invention and the attendant advantages will be readily apparent to those having ordinary skill in the art and the invention will be more easily understood from the following detailed description of the preferred embodiment taken in conjunction with the accompanying drawings wherein like reference characters represent like parts throughout the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an automated player according of the instant invention in mounted relationship to a guitar.

FIG. **2** is an enlarged partial view of the automated player of FIG. **1**, depicting plucking mechanisms in mounted relationship to a guitar.

FIG. **3** is an enlarged view of the automated player of FIG. **1**, depicting the fretting mechanisms of the player as preferred for a six-string instrument, such as a guitar.

FIG. **4** is a partial cross sectional view of a plucking mechanism according to the invention.

FIG. **5**A is a partial cross sectional view of a fretting mechanism according to the invention.

FIG. **5**B is a cross sectional view of a fretting mechanism according to the invention depicted secured to the neck or fingerboard of a stringed instrument by securing straps and latch buckle.

FIG. **6** is a cross sectional view of a plucking mechanism according to the invention.

FIG. **7** is an exploded view of a rotary plectrum shown in relation to the actuator assembly.

FIG. **8** is an end view of a rotary plectrum body.

FIG. **9** is a partial cross sectional view of the fretting mechanism taken along a line perpendicular to the instrument strings.

FIG. **10** is a simplified schematic of a carriage assembly according to the invention.

FIG. **11** is an electronic circuit for the components of the present invention as applied to a player adapted for playing a six-string instrument, such as a guitar.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A presently preferred embodiment of the invention is described below with reference to the drawings. An automated player **10** of the present invention, as shown in FIG. **1**, is adapted to be attached to the neck or fingerboard of a traditional stringed instrument, such as a guitar **5**. Although the automated player **10** is shown in connection with an instrument with a neck, the player **10** could also be modified for use with a harp or other stringed instruments that do not have a neck. For ease of illustration, the invention is described with respect to the well-known six-string guitar **5** (FIG. **1**) having a neck or fingerboard **3**, strings **2**, a head **9** and a bridge **6**. However, one skilled in the art will appreciate that the present invention may be adapted to operate any stringed instrument that is played by plucking the strings.

The automated player **10** is placed on the front of the guitar aligning locating pins **8** with a nut **4** located at the upper end of a neck or fingerboard **3** (FIG. **5**A). The locating pins **8** support the player **10** against the upper end of the neck or fingerboard while the player **10** includes a height adjustment thumbscrew **17** (FIGS. **2** and **4**) to support the player against the lower end of neck **3** and allow for different height requirements of different instruments. Two sets of straps extending from the underside of the player **10** are wrapped around the neck of the guitar **5** and buckled or suitably secured. FIG. **5**B shows straps **15** having a first end **15***a* and a second end **15***b*. The first ends **15***a* of straps **15** pass through strap slots **15***c* included in the player **10** and are secured in overlapping fashion with the rest of the strap **15** at point **15***d* by sewing or other suitable means of attachment. The second ends **15***b* of each strap are secured to each other by way of a draw latch buckle **15***d* or other suitable adjustable fastening means, such as by tying or use of hook and pile fasteners.

The player **10** preferably includes a rectangular body **12** constructed of aluminum or other suitable rigid material, such as plastic. The body **12** generally has a width slightly greater than the width of the neck or fingerboard of the instrument it is designed to play and preferably includes a glass or plexiglass window **18** such that the internal mechanisms may be viewed during operation of the player **10**.

The body **12** includes a first end **14** and a second end **16**. The first end **14** is adapted to house at least one plucking mechanism **20** in mechanical communication with a string **2**. The number of plucking mechanisms employed in the player **10** is determined by the number of instrument strings to be plucked, with one plucking mechanism associated with each string **2**. As best shown in FIG. **2** for the six-string guitar **5**, six plucking mechanisms **20** are therefore employed and preferably staggered whereby each string **2** of the guitar **5** has a plucking mechanism **20** individually associated with it.

Each plucking mechanism **20**, as detailed in FIGS. **4** and **6**, includes a rotary plectrum assembly **24** adapted to be placed in a string-contacting position relative to a string **2**. The rotary plectrum assembly **24** is placed such that the rotational axis of the plectrum assembly **24** is parallel to the longitudinal axis of the string, and preferably directly above the string.

The plectrum assembly, shown in FIG. **7** in greater detail, includes a plectrum body **26** having four spokes **27** extending radially with respect to a central bore **25**. Each spoke **27** includes a rounded damping edge **29** and a quill slot **28** for receiving a radially extendable quill **30**. The quills **30** include a lip **40** for receiving a garter spring **42** to retain the quills **30** in place. The quills are constructed so that they extend slightly further than the spokes **27** along the circumference of the plectrum body **26**. When placed in the quill slots **28** and retained by the garter spring **42**, the quills **30** define a central hole **43** coaxial with the central bore **25** and the lips **40** form a conical recess **41** adapted to receive a tapered cam **62**.

The plectrum body **26** further includes a hollow plectrum shaft **32** (See FIG. **6**) extending from the spokes **27** through duplex ball bearings **34** mounted in a protruding flange **36** of the body **12**. A first miter bevel gear **38** is mounted on the plectrum shaft **32** and adapted to be in mechanical communication with a second miter bevel gear **39** placed at a right angle to the first gear **38**. The second gear **39** is mounted to a steel shaft **44** that passes through a nylon thrust washer **37** and a needle bearing **45** mounted in the body **12**. A first timing pulley **46** is mounted on the steel shaft **44** opposite the second gear **39**. The first timing pulley **46** is adapted to be driven by a timing belt **50** (See FIG. **4**) in driving communication with a second timing pulley **47** engaged by a first stepper motor **48** mounted to the body **12** on a motor bracket **49**.

The plucking mechanism **20** further includes an actuator assembly **60** (See FIG. **6**) including a tapered cam **62**, an actuator shaft **64**, a stop collar **66**, a compression spring **80** and a solenoid actuator **82**. The solenoid actuator **82** is operably coupled to the actuator shaft **64**. The actuator shaft extends through the compression spring **80**, the hollow plectrum shaft **32** and conical recess **41**. The tapered cam **62** is attached to the actuator shaft **64** and retained in place with an E-type snap ring **63**. The tapered cam **62** is adapted to be received by the conical recess **41** formed by the quills **30** of the rotary plectrum assembly **24**. The compression spring **80** holds the actuator shaft in its fully extended position. The stop collar **66** includes a setscrew **68** that allows for adjustment of the actuator shaft's **64** range of motion relative to the compression spring **80**.

The second end **16** of the body **12** is adapted to house at least one fretting mechanism **90**. The number of fretting mechanisms **90** employed is determined again by the number of instrument strings and generally one fretting mechanism **90** is associated with each string **2** of the instrument to be fretted. As best shown in FIGS. **3**, **5** and **10**, each fretting mechanism **90** includes a carriage **94** comprising a segment of plastic tubing, preferably Teflon. When the player **10** is mounted to the guitar, the carriage **94** comes in contact with a string **2** and is partially compressed. The natural elasticity of the Teflon or plastic carriage **94** causes the carriage **94** to resist this compression, and thus, the carriage **94** depresses the string **2** against the fingerboard **3**. This elasticity also allows the carriage **94** to further compress and pass over the frets **7** easily and quietly during operation. The use of a Teflon tube segment also provides the carriage **94** with a wide contact area for contacting a string **2**, thus allowing an individual player **10** to be used with instruments having widely varying string spacing. Additionally, the low coeffi-

cient of friction of the carriage, preferably polytetrafluoroethylene, means quiet movement during operation and that no permanent abrasive damage is caused to the guitar **5**.

The carriage **94** includes belt slots **98** that allow the carriage **94** to be attached to a carriage belt **92**. The carriage belt **92**, preferably a Flex-E-Belt® manufactured by W. M. Berg, Inc., is generally continuous and is driven by a second stepper motor **51** (FIG. **2**) positioned near the first end **14**. One or more idler pulleys **97** (FIG. **3**) adapted to roll freely are mounted on dowel pins fixed to the body **12**. The idler pulleys **97** allow the carriage belt's **92** direction of travel to be manipulated to circumvent other fretting mechanisms and align with a desired string **2**, as well as direct the belt **92** through an area adapted for a belt return **93**. The Flex-E-Belt®, which consists of individual plastic, preferably polyurethane, links molded on a steel cable, allows the carriage belt to flex and therefore resist binding that a conventional steel chain would encounter during non-parallel travel as described below.

The carriage **94** slides in a guide channel or track **95** (FIG. **9**) formed in the body **12** or constructed of suitable material and attached to the body **12**, such as metal tracks attached to the underside of the plexiglass window **18**. The track **95** maintains the carriage **94** in direct and linear contact with the string **2** as the carriage **94** is driven by the belt **92**. Since the strings **2** of a guitar are not strung parallel to the fingerboard but incline toward the bridge **6** (see FIG. **4**), the track's **95** depth is progressively reduced as it nears the body of the guitar **5** so the carriage **94** travels in a line parallel with the fingerboard **3** while the rest of the player **10** is parallel to the string **2**. Such a correction for the unparallel relationship between the fingerboard **3** and string **2** provides for sufficient compressive force by the carriage **94** to fret the string **2** over frets **7** closer to the body of the guitar **5** while still easily traveling over frets **7** located farther up the fingerboard **3**. While it would be possible to adapt the player **10** such that the carriage **94** may be positioned past the nut **4** for open string notes, due to the excessive compression of the carriage **94** required to do so, preferably the user is instructed to manually de-tune the instrument a musical half step (one fret) downward. Then, when the carriage **94** is next to the nut **4** (FIG. **5**A) (at the first fret) the player **10** will generate a note equivalent to the normal, open-stringed value.

The body **12** includes an embedded electronic control circuit **99** (not show) in communication with each stepper motor **48** and **51** or solenoid actuator **82** such that they operate independently of each other and are operable in sequence to produce pre-programmed music. FIG. **11** depicts a block diagram of the embedded electronic control circuit **99** of the present invention for a six-string player **10** as shown in FIGS. **1** and **2**. The control unit **100** includes a keypad **102**, a display **104**, a microcontroller **106** and a EEPROM memory **108**. Instructions may be stored in random access memory or downloaded via a serial connection that may be connected to a computer or other MIDI device. The microcontroller **106** processes the instructions stored in memory or downloaded via a serial connection and outputs a signal to each stepper drive **107** associated with a stepper motor **48** and **51** and a power transistor **105** associated with a solenoid actuator **82**. These signals control the movement of the stepper motors **48** and **51** and solenoid actuators **82**, respectively. The activation of the motors **48** and **51** and solenoids **82** produce the desired mechanical action on the strings **2** to produced the desired sounds. All programming would take into account any manual de-tuning required for open note playing.

In operation, the plectrum body **26** is initially positioned against the string **2** such that a spoke **27** is contacting the string **2**. Upon a proper signal communicated from the microcontroller **106**, the stepper motor **48** exerts a driving force that is transferred through the timing belt **50**, timing pulley **46**, steel shaft **44** and first and second miter bevel gears **38** and **39** to rotate the plucking assembly about an axis parallel to the string to be plucked. As the plectrum assembly **24** is indexed 45 degrees rotationally, the string **2** is plucked by the passing quills **30** and the plucked string **2** vibrates freely. If the plectrum assembly is indexed another 45 degrees, the rounded damping edge **29** of the next spoke **27** comes into contact with the string **2** and it is damped and ready to be plucked again by a 45 degree indexing of the plectrum assembly **24**.

The present invention advantageously allows for varying the volume generated by the plucking of the string **2**. When a signal is communicated from the microcontroller **106** to the solenoid actuator **82**, the solenoid actuator **82** generates a pulling force on the actuator shaft **64** and compresses the compression spring **80**. The tapered cam **62** is pulled into the conical recess **41** and the quills **30** are forced radially outward to protrude farther from the plectrum body **26**. As the plectrum assembly **24** is indexed pass the string **2**, the now farther protruding quills **30** exert a greater displacing or plucking force on the string **2**. The greater plucking force results in greater vibration and thus greater volume. The amount of protrusion (and thus the volume produced) can be controlled by varying the amount of voltage applied to the solenoid actuator **82**.

From the foregoing description of a preferred embodiment, one skilled in the art will appreciate that various modifications and variations can be made in the structure of the automated player **10**. For example, while the preferred embodiment was described with regard to use of stepper motors and solenoid actuators, one skilled in the art may substitute other means known in the art for imparting the forces required to rotate the plectrum assembly **24**, extend the quills **30** or drive the carriage belt **92**. Furthermore, one skilled in the art will appreciate that the player may be adapted for instruments with any number of strings or other physical shapes different from the guitar as shown. Thus, it will appear to those skilled in the art that various modifications and variations can be made in the structure of the automated player **10** of the present invention without departing from the scope or spirit of the invention. It is intended that the present invention cover the modifications and variations of the invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An automated player for playing an unmodified stringed instrument comprising:

at least one plucking mechanism operable to selectively and releaseably contact and displace a corresponding instrument string such that the instrument string vibrates and produces a sound, and wherein said plucking mechanism further comprises

(i) a string-contacting portion rotationally mounted relative to the corresponding string and having a rotational axis substantially parallel to the corresponding instrument string, said string-contacting portion including at least one extendable quill,

(ii) a first drive member in mechanical communication with said string-contacting portion and capable of creating relative movement between the first drive member and the string-contacting portion,

(iii) an actuator in mechanical communication with said at least one extendable quill, said actuator operably engaging said at least one quill whereby to create relative movement between said actuator and said at least one quill, whereby said at least one quill is selectively extendable to vary the displacement of said string during a rotation of said string-contacting portion.

2. The automated player of claim **1**, wherein the string-contacting portion comprises a plurality of spokes, said spokes each housing a quill and being defined by a first edge and a second edge, at least one of said first or second edge being substantially rounded; whereby, the substantially rounded edge may be selectively brought into contact with the instrument string to variably damp vibrations.

3. The automated player of claim **2**, wherein the player further comprises an electronic circuit control, said circuit control in electrical communication with said actuator and said first drive member, said circuit control operable to selectively output signals to the first drive member and the actuator to operate said plucking mechanism.

4. The automated player of claim **1** further comprising at least one fretting mechanism operable to selectively depress the corresponding instrument string such that the vibration of the instrument string occurs over a desired string length, said fretting mechanism comprising:

(i) a carriage operable to be placed in depressive contact with the instrument string; and,

(ii) a second drive member in mechanical communication with the carriage and capable of creating relative movement between the second drive member and the carriage, said second drive member operable to selectively position the carriage.

5. The automated player of claim **4**, wherein the string-contacting portion comprises a plurality of spokes, said spokes each housing a quill and being defined by a first edge and a second edge, at least one of said first or second edges being substantially rounded; whereby, the substantially rounded edge may be selectively brought into contact with the instrument string to variably damp vibrations.

6. The automated player of claim **4**, wherein the carriage comprises a segment of plastic tubing.

7. The automated player of claim **4** wherein the carriage is attached to a carriage belt in mechanical communication with the second drive member.

8. The automated player of claim **7**, wherein the carriage belt comprises individual plastic links molded to a cable.

9. The automated player of claim **6**, wherein the segment of plastic tubing comprises polytetrafluoroethylene.

10. The automated player of claim **5**, wherein the player further comprises an electronic circuit control, said circuit control in electrical communication with said actuator and said first and second drive members, said circuit control operable to selectively output signals to the first and second drive members and the actuator to operate said plucking and said fretting mechanisms.

11. The automated player of claim **10**, wherein the first and the second drive members comprise stepper motors, and the actuator comprises an electric solenoid.

12. An automated player for playing an unmodified stringed instrument comprising:

(A) at least one plucking mechanism operable to selectively and releaseably contact and displace a corresponding instrument string such that the instrument string vibrates and produces a sound, and wherein said plucking mechanism further comprises

(i) a string-contacting portion rotationally mounted relative to the corresponding string and having a rotational axis substantially parallel to the corresponding instrument string, said string-contacting portion including at least one extendable quill,

(ii) a first drive member in mechanical communication with said string-contacting portion and capable of creating relative movement between the first drive member and the string-contacting portion,

(iii) an actuator in mechanical communication with said at least one extendable quill, said actuator operably engaging at least one quill such that there is relative movement between the actuator and the quill, whereby said at least one quill is selectively extendable to vary the displacement of said string during a rotation of said string-contacting portion; and,

(B) at least one fretting mechanism operable to selectively depress the corresponding instrument string such that the vibration of the instrument string occurs over a desired string length, said fretting mechanism comprising:

(i) a carriage operable to be placed in depressive contact with the instrument string; and,

(ii) a second drive member in mechanical communication with the carriage and capable of creating relative movement between the second drive member and the carriage, said second drive member operable to selectively position the carriage.

13. The automated player of claim **12**, wherein said string-contacting portion comprises a wheel having four spokes extending radially with respect to a central bore, each of said spokes including a quill slot adapted to receive an extendable quill.

14. The automated player of claim **13**, wherein said four spokes include a first edge and a second edge, at least one of said first and second edges being substantially rounded, whereby the substantially rounded edge may be selectively brought into contact with the instrument string to variably damp vibrations.

15. The automated player of claim **12**, wherein said carriage comprises a segment of plastic tubing.

16. The automated player of claim **13**, wherein said carriage is engaged by a carriage belt in mechanical communication with said second drive member.

17. The automated player of claim **16**, wherein said carriage belt comprises a flexible belt constructed of individual plastic links affixed to a cable.

18. The automated player of claim **17**, wherein said carriage comprises polytetrafluoroethylene.

19. The automated player of claim **18**, wherein the player further comprises an embedded electronic circuit control, said circuit control in electrical communication with said actuator and said first and second drive members, said circuit control operable to selectively output signals to the first and second drive members and the actuator to operate said plucking and fretting mechanisms.

20. An automated player for playing an unmodified stringed instrument comprising:

(A) at least one plucking mechanism operable to selectively and releaseably contact and displace a corresponding instrument string such that the instrument string vibrates and produces a sound, and wherein said plucking mechanism further comprises

(i) a string-contacting portion rotationally mounted relative to the corresponding string and having a rotational axis substantially parallel to the longitudinal axis of the corresponding instrument string, said string-contacting portion comprising four spokes extending radially with respect to a central

bore, each of said spokes including a quill slot adapted for receiving an extendable quill, said spokes further including a first edge having a substantially rounded periphery, whereby said first edge is operable to be selectively brought into contact with said string to variably damp string vibrations,

(ii) a first drive member in mechanical communication with said string-contacting portion and capable of creating relative movement between the first drive member and the string-contacting portion, said first drive member comprising a first stepper motor,

(iii) an actuator in mechanical communication with said extendable quills, said actuator operably engaging said quills such that there is relative movement between the actuator and the quills, said actuator including a shaft coupled to a solenoid, said shaft having a tapered end adapted to engage said extendable quills, whereby said solenoid is energized to selectively extend said quills to vary displacement of said string during a rotation of said string-contacting portion; and,

(B) at least one fretting mechanism operable to selectively depress the corresponding instrument string such that the vibration of the instrument string occurs over a desired string length, said fretting mechanism comprising:

(i) a carriage comprising a segment of tubing mounted to a flexible belt and adapted to be placed in depressive contact with the instrument string; and,

(ii) a second drive member in mechanical communication with the flexible belt and capable of creating relative movement between the second drive member and the carriage, said second drive member comprising a second stepper motor operable to selectively position the carriage.

21. The automated player of claim **20**, wherein the player is a separate construction operable for detachably mounting to an unmodified guitar.

22. A method for electronically playing a musical instrument having a plurality of strings and a plurality of frets extending transverse to the strings, said method comprising:

a) selectively rotating at least one of a plurality of first members, each first member being associated with one of the plurality of strings of said musical instrument and each adapted to rotate about a rotational axis substantially parallel to the associated string, each first member having an electrically operated driver which when energized rotates the associated first member, each first member having a string contacting member extending radially outwardly from the rotational axis of said first member a sufficient distance to contact and effect plucking of the associated string when said first member is rotated;

b) selectively moving at least one of a plurality of string depressing second members substantially parallel to the string, each of said string depressing members being associated with one of the plurality of strings of said musical instrument and each second member having an electrically operated second driver adapted to move the associated second member to a position above one of the frets of the musical instrument and adapted to press the associated string into contact with said one fret in time with the rotation of the first member associated with that string; and,

c) electronically energizing said first and second drivers to effect plucking and fretting of the strings of said musical instrument in a predetermined time sequence to effect playing of the instrument.

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